

Monitoring the Indonesian Throughflow in Makassar Strait

Arnold L. Gordon and R.Dwi Susanto

Lamont-Doherty Earth Observatory of Columbia University, Palisades NY

1. PROGRESS REPORT

The transfer of tropical Pacific water into the Indian Ocean through the Indonesian seas, the so-called The Indonesian Throughflow (ITF), is a significant part of the ocean system of interocean fluxes, ocean-scale heat and freshwater budgets and sea-air fluxes. The ITF is believed to provide an interactive link with the ENSO and Asian monsoon climate features. Additionally, the ITF to a large extent governs the overall oceanographic stratification, circulation and ecosystems within the Indonesian Seas.

The ITF amounts to ~ 12 Sv, $>80\%$ of which is channeled through Makassar Strait. The 45 km wide Labani constriction of Makassar Strait near 3°S is an ideal place to measure the bulk of the ITF. There the throughflow was measured during the NSF funded INSTANT program from January 2004 to November 2006. The Figures 1, 2 3 provide a view of the 3 year INSTANT time series within Makassar Strait.

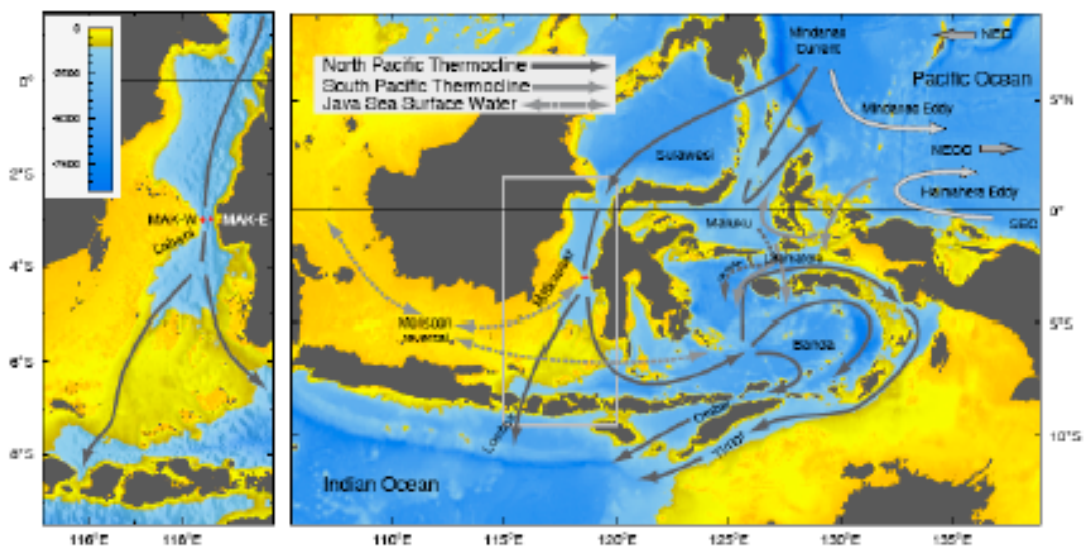


Figure 1. Schematic of the Indonesian Throughflow pattern is shown in the right panel. In the left panel, the Makassar Strait region (as delineated by the grey box in the right panel) is expanded, and the solid grey lines mark the approximate pathway of the Makassar throughflow.

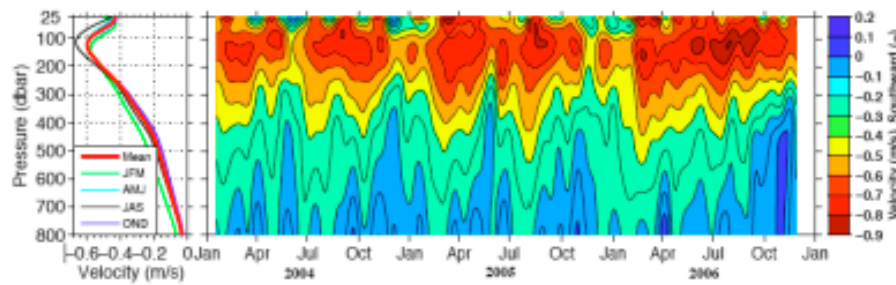


Figure 2. The along-channel velocity section (right panel) and seasonal profiles (left panel). The velocities represent an average of MAK-west and the MAK-east values. The vertical coordinates are given in decibar (dbar), which is approximately a meter (m).

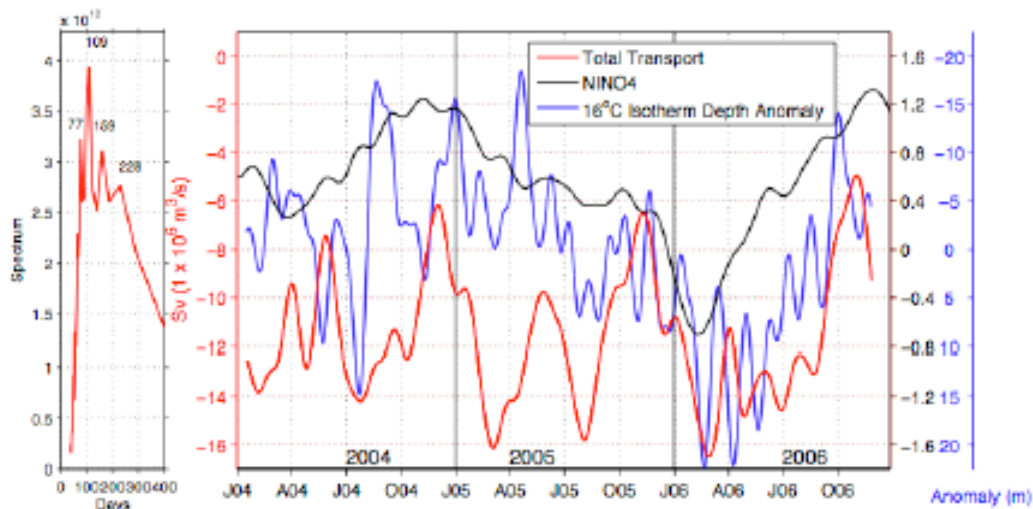


Figure 3. The right panel shows the total Makassar Strait volume transport (S_v , red line, red left axis) and depth anomaly of the 16°C isotherm (m, blue line, blue right-most axis) after a 30-day low pass filter has been applied, as well as the Niño4 time series (area-average SST anomaly within 5°N to 5°S, 160°E to 150°W; black line, inner right black axis). The spectrum (power spectral energy, S_v^2/day) of the total Makassar Strait volume transport is shown in the left panel with the peaks (in days) of the periods labeled.

The objective of the NOAA/OCO program is to extend the INSTANT time series so as to establish a long-term measurement program of the ITF within Makassar Strait. Such an extended time series (decadal scale) is needed to better relate the ITF to such climate fluctuations as those associated with El Niño, the Indian Ocean Dipole and of the Asian monsoon. “Monitoring the Indonesian Throughflow” contributes to the global ocean observational system overseen by the Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC), <http://ioc3.unesco.org/oopc/>.

2. ACCOMPLISHMENTS

Immediately after the INSTANT moorings were recovered on 22 November 2006, with NOAA OCO support, a single mooring at the site of the INSTANT MAK-

WEST 2°51.11'S; 118°27.33'E was deployed (Figure 4). The NOAA Makassar mooring will be recovered and redeployed in April 2009. A two-year rotation schedule is the plan, with specific dates dependent on ship availability (which explains the slightly longer than 2 year deployment of this 1st rotation).¹

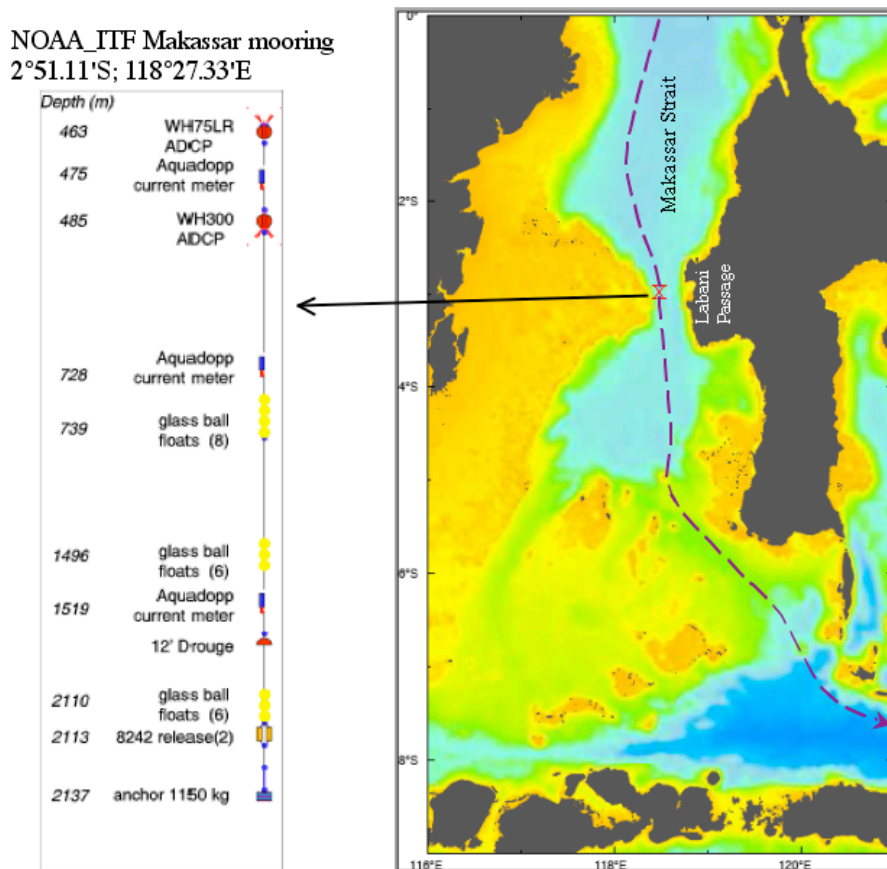


Figure 4. Configuration of the NOAA-ITF Makassar mooring deployed in November 2006 at the Red X in the bathymetry map of Makassar Strait.

During the FY08 period we engaged in discussion concerning the timing of the mooring rotation, which is now scheduled for the April/May period of 2009, at the end of the present FY08 funded increment.

In June 2008 we signed the Implementation Agreement defining the parameters of the cooperative effort between Lamont-Doherty Earth Observatory and Agency for Marine and Fisheries Research (BRKP).

¹ Note added, June 2009: The NOAA funded mooring, deployed on 22 November 2006 at 2°51' S; 118°28' E, was recovered on 31 May 2009, and re-deployed for another 2 years to continue to build the time series. With the 2004-2006 INSTANT program mooring at the same site, we now have a 5.5 year continuous time series of Makassar throughflow.

When we obtain the first products of the NOAA/OCO Makassar ITF mooring the data will be processed and placed on a web site at Lamont, where it will be available for the community. This will be updated within 12 months of every mooring rotation.